

Transportation Research

Mobility & Intermodal Planning

Research has been conducted on transportation efficient development, pedestrian infrastructure, incident management, freight movement, and multi-modal investment analysis. Current research addresses understanding land use and transportation interactions, developing traveler information systems, evaluating HOV lanes, understanding intermodal truck-rail facilities, improving data collection, and improving freeway flow analysis.

Topics that need additional research in the planning arena include: land use and growth management; concurrency as it af-

fects state highways; methods to mitigate effects of development on the transportation system; understanding the economic effects of goods movement and the transportation needs of the economy (freight movement, tourism) and regionally adopting new technologies; environmental stewardship and streamlining; consensus building and collaborative decision-making techniques/processes; and, travel forecasting based on actual customer practice.

What are the benefits of research activities?

Research results have greatly improved the longevity of pavements, the safety of road design, and the speed and safety of construction methods. A handful of examples are illustrated below:

- Between 5 TV stations and WSDOT’s own website, about 3.2 million page views per day are made to state traveler information Web sites to check traffic conditions before people start their journeys (<http://www.wsdot.wa.gov/traffic/>). Freeway operations research led to the real time video of freeways and the traveler information system and more accurate congestion maps.
- Materials research has improved the longevity and performance of pavements and provided a reduction in cost, improved work methods, and safer performance.
- Research conducted on eelgrass provided Washington State Ferries with information needed to streamline permit negotiations.
- Seismic research for structures is the basis of our seismic retrofit program today.
- Research on a new and highly sophisticated Ramp Metering Algorithm led to decreased mainline congestion and increased flow on I-90. On I-405, the ramp queues decreased significantly, but mainline congestion increased only marginally.
- WSDOT’s dowel bar retrofit program, a product of research, saves an estimated \$90,000 per lane mile of asphalt overlay. As of 2006, over 300 miles of Portland Cement Concrete Pavements (PCCP) have been retrofitted using dowel bars, and over 100 miles are scheduled to be completed in the next 5 to 10 years.
- WSDOT’s research on Cable Median Barriers is helping to reduce head-on across median crashes, which kill an average of 130 people each year.
- WSDOT’s Pedestrian Safety research is evaluating methods to reduce pedestrian deaths and injuries as education, enforcement and engineering to reduce pedestrian deaths and injuries. Sixty pedestrians were killed in Washington State in 2004--down from seventy-five in 2003 and ninety-two in 1996.
- Research on hot-mix asphalt (HMA) temperature differentials has resulted in a standard specification to combat their occurrence during construction. The cost savings are difficult to estimate, but taking into consideration the amount of HMA WSDOT places each year, the average cost per ton, and the occurrence of temperature differentials in recent years, more than \$6 million in savings per year could be achieved.

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June 2006

Transportation Research

A program of systematic inquiry designed to address specific problems and questions to improve the agency's ability to deliver transportation projects and to operate a safe and efficient transportation system.

Why conduct research and development projects on transportation?

Research establishes understanding of why certain problems occur and how to prevent them. Development projects advance the use of new technologies and information through the creation of tools, methods, and manuals. Effective research and development projects address issues that limit delivery and operation of the state’s transportation system.

How do we fund transportation research?

Organized federal research efforts began in 1893. Direct federal funding to states for transportation research began in 1934, and has seen changes over time to funding formulas. The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) was enacted August 10, 2005, as Public Law 109-59. SAFETEA-LU requires that at least 25% of federal state planning and research (SPR) funds be directed to research and to receive a 20% state match.

Washington State Department of Transportation (WSDOT) Research

The Research Office is part of the Office of Research and Library Services. At WSDOT, the Office of Research and Library Services manages the research and development program, which includes the Federal SPR program and other federal and state funded research. In all, WSDOT will manage at least 94 projects (41 funded by SPR, 11 FHWA pooled fund projects, 37 projects sponsored by other WSDOT offices and 5 active federal grants) during the 05-07 biennium. The total biennial value of those projects will be no less than \$9,633,733.

Since 1972, the WSDOT Research Program has produced over 800 research reports.

Who's doing Transportation Research in Washington?

Washington Transportation Center (TRAC)

In 1983, WSDOT, the University of Washington and the Washington State University formed a partnership that established the Washington Transportation Center (TRAC). TRAC provides a link among the government, university researchers, and the private sector. TRAC acts as a liaison, connecting those who need applied research at WSDOT with those best suited to conduct it at the universities. TRAC also conducts research for other institutions upon request such as local government, Metropolitan Planning Organizations, and other institutions.

Transportation Northwest (TransNow)

TransNow is one of ten regional research centers of the National Transportation Centers Program. TransNow is a partnership

between the University of Washington and Washington State University. In addition, TransNow helps showcase transportation research and education in the Pacific Northwest (Federal Region 10) which includes Washington, Oregon, Idaho, and Alaska. The program is led by the University of Washington. TransNow is interested in research and educational programs that fall under the theme of “Operations Management and Planning.” Sub-areas include traffic operations, transit operations, and intermodal or other-modal operations.

How have we spent our research funding?

Research and development activities address topics identified by the WSDOT Research Advisory Committees (RAC).

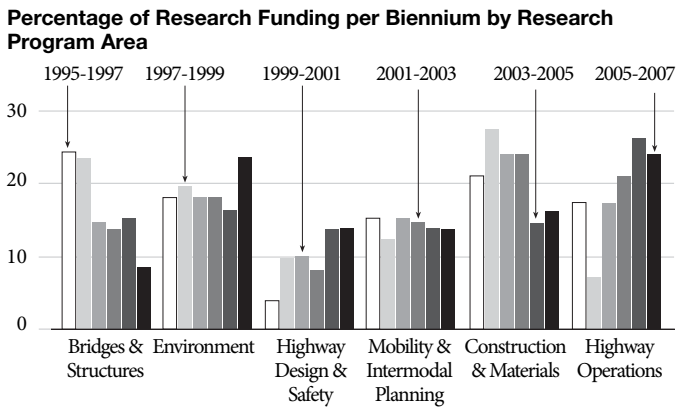
The Project Delivery RAC topical interests include: Bridges and Structures; Construction and Materials; Design (Context Sensitive Design; Design Build; Geometric Design; Hydraulics; Safety) Environment; and, Real Estate.

The Operations RAC topical interests include: Congestion; Intelligent Transportation Systems; Traffic Management; Maintenance; Roadside Management; Safety; Security; and, Communications.

The Multimodal Transportation RAC topical interests include: Aviation; Freight; Highways; Planning; Urban Planning; Public Transportation; Transportation Demand Management; Rail; and Washington State Ferries Planning.

The Information and Finance RAC topical interests include: Data (Collection and Management); Transportation Funding; Information Technology; Performance Measures; Programming; Workforce Management; and, Access Management.

Funding has varied by year depending on agency needs and opportunities.



What type of research is conducted?

Bridges & Structures

WSDOT’s Bridge & Structures Office is one of the best in the country. The bridge research program focuses on designing of state-of-the-art bridges, managing the bridge inventory and protecting structures from damage by natural disasters like earthquakes and floods.

Direct results of the bridge research program over the past 20 years include a ground-breaking bridge deck management system, a seismic retrofit strategy to reduce the vulnerability of our bridges, and participation in FHWA’s High Performance Bridge Program, which increased use of higher strength girders that have increased the span, reduced the number of piers and reduced environmental impacts. Current research includes studies in rapid construction and seismic retrofit.

Additional research is needed in seismic retrofits, rapid construction methods, non-destructive inspection regimes and security measures. Longer-term needs include developing alternative materials such as composition materials.

Highway Operations

Highway Operations includes traffic management and maintenance.

Research has focused on developing techniques to accurately count traffic using available sensors, improving access to weather-related information and monitoring freeway traffic conditions.

Other research has been conducted on the state’s incident management program, using voice recognition for a statewide 511 traveler information line, installing electronic seals on commercial freight containers to speed US Customs handling, and using technology to allow safe and legal trucks to bypass weigh stations.

Current research activities include providing data from existing technologies for use with variable message signs and highway advisory radio systems; investigating the use of buses to monitor travel times; collecting data on freight movement and expanding systems for archiving roadway data or turning it into useful performance measures.

Environment

Environmental research helps WSDOT maintain and improve the environment where new projects are built. Research contributes to a common foundation for decisions between WSDOT, permitting agencies and others, thus avoiding unnecessary redesign, schedule delays and cost increases.

In recent years WSDOT has focused its environmental research efforts on stormwater run-off and water quality and on species issues such as wildlife migration corridors, the impact of salt on endangered plants, and the impact of overwater structures on eelgrass and salmon. Literature reviews have been conducted on species listed or about to be listed under the Endangered Species Act to understand the potential impact of transportation

activities. Results have been used to update agency manuals and to streamline permitting decisions.

Environmental research subjects span the breadth of environmental issues covered in the National Environmental Policy Act (NEPA)



and other federal, state, and local environmental regulations. Potential research subjects include impacts to and mitigation strategies for: fish, wildlife, and plant species; air quality; noise; water quality; wetlands; cultural and historic resources; hazardous materials; socio-economic issues;

landuse; and visual quality. Priorities for research include addressing common project delays due to questions on environmental parameters and methods that streamline the environmental review process to expedite project delivery while meeting the environmental requirements are priorities.

Construction & Materials

Past research has resulted in a variety of improvements to new mix, pavement design and management systems; the development of design criteria for cut slopes in loess soils, a formula on the load carrying capacity of driven piles, and completion of a seismic zone map.

Current research focuses on the use of geosynthetic fabrics to reinforce of walls, liquefaction hazards, wiremesh and cabledmesh slope protection design criteria, changing the pavement management system from a PC based system to an Internet based system, new design guidelines for the mixes and placement methods for Portland cement concrete pavements, and a compilation of case histories on rapid construction methods.

Research needs include studies on marginal soils; seismic issues; liquefaction of soils; structural design and analysis tools; pavement materials, performance, rehabilitation of major urban corridors, construction; and, information systems and training.

Design & Safety

Design and Safety research includes: roadway/roadside safety: design standards; roadside development; hydraulics; context sensitive design; and, access management.

Research activities have focused primarily on understanding and addressing conditions that lead to accidents and hydraulic issues that address stormwater, scour at in-water structures, and streambank stabilization. The results of research have been used to update agency manuals and have contributed to updates to national standards.

Research needs include: highway, pedestrian, and bicycle safety research; stormwater treatment methods; context sensitive design; project delivery tools; cost management; roadside management; and, design/build methods.